

# Aquatic Invasion!

**Purpose:** To understand the properties of [invasive species](#) and learn about [aquatic invasive species](#) and their effect on aquatic ecosystems.

**Summary:** In the exercise, students will investigate aquatic invasive species. They will choose one aquatic invasive species, investigate its distribution, life history, and possible solutions or management practices to control the species and/or its impacts. From this information students will create an “unwanted” poster to engage local citizens and help them understand the importance of controlling the organism.

**Background:** Invasive species are non-native (or alien) to an ecosystem whose introduction causes, or is likely to cause, harm to the economy, the environment, or human health. Not all [non-native species](#) are considered invasive, since many non-native species are not able to spread or reproduce once introduced to a new habitat. Some non-native species provide economic benefits, like crops, and are not considered invasive.

Invasive species may prey upon, displace or otherwise harm [native species](#). They may also alter ecosystem processes, transport disease, or cause illnesses in animals and humans. Invasives can affect the commercial, agricultural, aquacultural, and recreational activities dependent on such waters, resulting in severe economic impacts. Control of invasives can be extremely difficult once they are established.

Many natural barriers exist which help isolate species and prevent their introduction into new regions. Invasive species must overcome barriers in the environment that would otherwise prevent their spread. These barriers are:

- **Geographic barriers** such as a mountain range, ocean or river that prevents easy movement from one area to another and separates different habitats.

**Duration:**  
Classroom  
2 hours  
Outdoors  
1 hour

**Setting:**  
Classroom  
Outdoors

**Core Standards:**  
6th grade  
Science ILOs:  
1g, 3c, 5a,

7th grade  
science ILOs:  
4b, 4c, 5a,

8th Grade  
Science: 2.3a,

High School  
Science ILOs:  
2a, 2b, 2d, 3a,  
3c, 4a, 4b, 4d,  
5a,

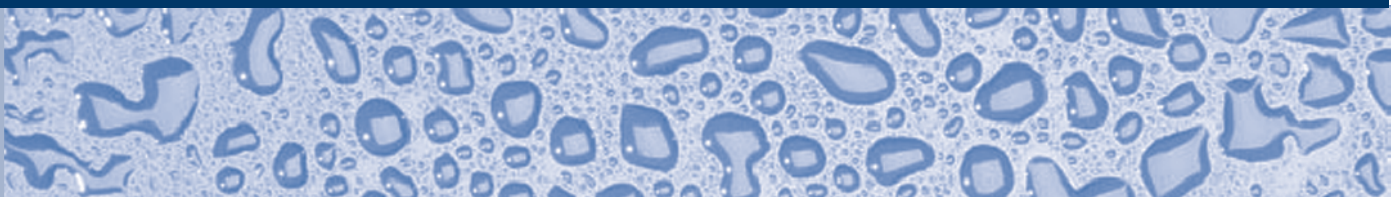
Earth Systems  
Science: 4.2b

Biology: 1.3c,  
1.3d, 1.3e

Geography for  
Life: 2.1b,

NR Science  
II: 3.1f, 4.1a,  
5.3e

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- **Survival and establishment barriers** are environmental features that prevent an introduced species from thriving. These might include soil moisture and pH for plant species, water temperature, pH, or salinity for aquatic species.
- **Dispersal and spread barriers** are natural or constructed blockades such as a wall of vegetation on land or a barrier of electricity in water. These are made to prevent rapid dispersal and spread from the site of establishment.

Human activities are often the culprit in introducing and perpetuating the spread of invasive species. Here are some examples of human activities which have served as pathways for spreading invasive species:

- **Illegal fish stocking:** Illegally introducing a non-native fish into a water body.
- **Legal stocking:** Legally introducing a non-native fish into a water body, usually for recreational fishing, or for population controls on other fish.
- **Ships and boats:** To stabilize ships, water is often taken into a ballast tank. Aquatic organisms can be taken in and transported in this ballast water. Organisms can also be transported by attaching to the ship itself, this is called hull fouling.
- **Ornamental plants:** Some ornamental plants can spread into the wild and become invasive.
- **Pet trade:** Intentionally or accidentally releasing pets into their non-native habitat.
- **Wood:** Insects can get into wood, shipping palettes, and crates that are shipped around the world.

#### **Proper retiring of classroom animals**

- o Give the animal to another responsible teacher
- o Return it to the place where it was purchased (perhaps make prior arrangements to do so)
- o Keep it as a classroom pet
- o Donate it to your local natural history museum, zoo, or aquarium (check before you acquire the animal)
- o Humane euthanasia (contact your local veterinarian for advice)

For more information, see: <http://wildlife.state.co.us/WildlifeSpecies/Living-WithWildlife/Pets/>

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- **Agriculture:** Invasive pests and diseases can be transported across US borders through the commercial or personal transport of agricultural items, such as fruit, vegetables, and plants.
- **Improperly cleaned equipment:** Fieldwork and recreational activities can unintentionally spread invasive species on the equipment that is used.

For more information on [aquatic invasive species](#) please call the Division of Wildlife Resources at (801) 538-4700, email [larrydalton@utah.gov](mailto:larrydalton@utah.gov), or see:

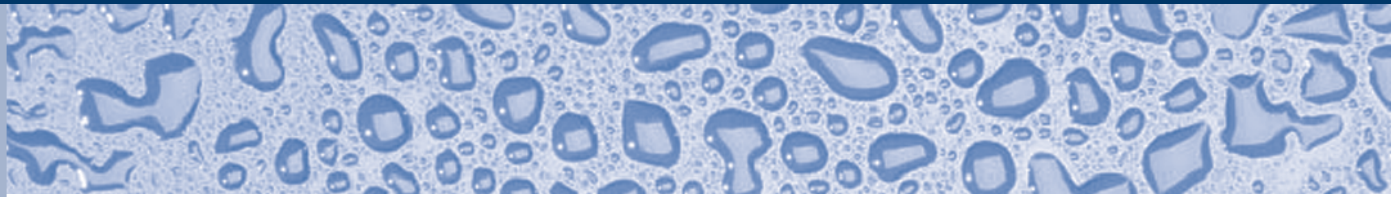
- <http://wildlife.utah.gov/mussels/plan.php>
- <http://invasivespeciesinfo.gov/docs/council/isacdef.pdf>
- <http://protectyourwaters.net/prevention>
- <http://www.utahweed.org/>
- <http://ag.utah.gov/divisions/animal/fish/nuisance.html>

- Materials:
- Computer with internet access
  - Poster paper
  - Miscellaneous art supplies
  - Group presentation worksheet
  - Waders
  - Plastic pan
  - Kick net
  - Invasive species pictures

## Classroom Part 1

- Activity:
1. Define the term [aquatic invasive species](#). Aquatic invasive species are non-native to the ecosystem under consideration whose introduction causes or is likely to cause harm to the economy, the environment, or human health. Talk about why invasive species are a threat to [native species](#) in a given ecosystem.
  2. Give students examples of invasive species. Examples can be found in the Resource pages of this lesson.
  3. Ask the students if they can think of any local examples of aquatic invasive species. Ask them if they can think of any possible ways the invasive species were introduced into the ecosystem. Be sure to inform them of the human activities which often introduce aquatic invasive species to an ecosystem.

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## Part 2

1. Explain to the students that they will be researching and presenting on a specific [aquatic invasive species](#) within Utah.
2. Separate the students into small groups of three or four. Assign each group a specific aquatic invasive species that is affecting the state. A list of aquatic invasive species can be found in the Resource section of this lesson.
3. Have students use the Internet to research their assigned invasive species. From their research, students will fill out the accompanying worksheet found in the Resources section of this lesson. Be sure they list the reference.
4. Each group will then make a creative, informative poster of their invasive species using the information from their research worksheet (see the Resource section of this lesson for an example). This can be done on the computer or with art supplies.
5. After the posters are completed, each group will use their posters as a visual in a presentation on their aquatic invasive species. Additionally, the posters can be displayed within the school or community in order to educate others on aquatic invasive species within Utah.

### Field Activity:

1. Take a field trip to a local, safe, accessible water body. It could be a river, pond, lake, reservoir, or stream.
  - As with any field trip, exercise appropriate safety precautions. See **Appendix A** in this manual for more information on safety in the field.
  - This is an excellent opportunity to teach the students the responsibility of field work and even recreation. Use Best Management Practices (BMP) discussed in the Further Discussion questions.
2. Lead a discussion about invasive species. Perhaps start by asking the students what activities take place at the field trip location. Then focus on how these activities may facilitate the spread of invasive species if the proper precautions are not taken.



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3. Have the students look at pictures of different invasive species located within Utah. Talk about the environments where these species live. Ask the students which of the species they know are located, or have potential to be located, within the field trip location.
4. Ask the students how they think the invasive species could have gotten there.
5. Have the students sample the water body using the kicknet. It is likely that the students will not find an invasive species; however, this is an opportunity to train them to use Best Management Practices (BMPs) in their fieldwork (e.g., properly disinfecting waders, kicknets, and any other equipment used in the water).

## ACTIVITY EXTENSIONS:

- Write to a government agency or political leader with concerns and recommendations for [aquatic invasive species](#).
- Have students create an outreach campaign for the community based on their posters of the aquatic invasive species. This can include tips and suggestions for the prevention of introduction and spreading of aquatic invasive species.
- Have a guest speaker from an agency implementing invasive species action plans or with knowledge and experience on invasive species come speak to the class.

Further Discussion: **1. What are the characteristics of an environment that is vulnerable to invasive species?**

- ***Lack of biotic constraints:*** Natural predators or disease, which the invading organism had in its native environment are biotic constraints. Natural predators help control populations of their prey. Since an invasive species often has no natural predator in its non-native environment, its population rapidly increases. With a large population, it is easy for an invasive species to outcompete native species.
- ***Disturbances:*** Fire, construction, agriculture, etc., prior to the invasion cause a disruption in an ecosystem's natural function and structure. A disrupted ecosystem is vulnerable to invasive species establishment.

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- **Proximity to potential sources of invasive species:** Since people transport many non-native species, urban areas and recreational areas typically have a high number of invasive species.

*New species often find their way into new ecosystems, but not all become nuisance species. In order for a non-native species to become an invasive species, it must harm and negatively impact its new environment.*

## 2. What can be done to control aquatic invasive species?

- **Mechanical Control** removes an invasive species by hand or with a machine. The process is often very labor intensive and needs multiple efforts. In Utah Lake, the Common Carp is being removed using boats, large nets, and hand labor to capture and remove about five million pounds of fish annually over a six year period. Trapping, electricity, trawling, or baiting may also be used.
- **Chemical Control** uses chemical applications to control invasive species. The chemical Rotenone is often used to treat water bodies infested with invasive fish species. However, chemicals like Rotenone, such as pesticides, herbicides, or other piscicides, are often not target-specific and can harm water resources as well as other plants and animals besides invasive species.
- **Biological Control** involves the release of a new species in the environment to control an invasive species. A biological control agent, the Saltcedar Leaf beetle *Diorhabda elongate*, has been released in nine western states including Utah in order to control tamarisk populations.

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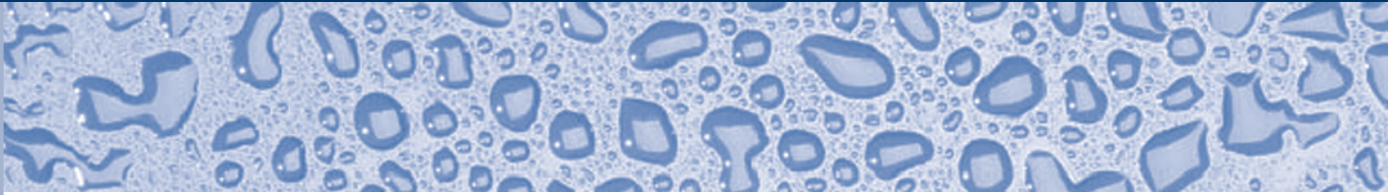
## 3. What are specific procedures to protect against introduction of aquatic invasives?

- *Assume every water body is contaminated and that boats and equipment should always be considered contaminated*
- *Eliminate water from all equipment before transporting anywhere*
- *Remove all visible mud, plants, and fish/animals*
- *Keep one set of equipment for use only on infested waters*
- *Decontaminate equipment following each use, whenever possible, by cleaning and drying anything that came in contact with the water*
- *Keep boat and equipment clean between trips and let dry for as long as possible*
- *Do not release or put plants, fish or animals into a body of water unless they came out of that body of water*
- *Report the finding of an aquatic invasive species to the Utah Division of Wildlife Resources at 801-538-4700*

## 4. Why are the definitions of invasive species sometimes unclear?

*Some non-native species are considered harmful and therefore invasive by some sectors of our society while others consider them beneficial. This discontinuity is reflective of the different value systems operating in our free society and contributes to the complexity of defining the term invasive species. (<http://www.invasivespeciesinfo.gov/docs/council/isacdef.pdf>)*

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## **5. How do aquatic invasive species affect water quality?**

*Aquatic invasive species affect water quality through small changes in the ecosystem. These small changes have a significant, negative impact over time. One example of this is the Common Carp. This is a fish which feeds by browsing through underwater vegetation. This feeding uproots plants which muddies the water and destroys the food and cover needed by other fish. Another example of this is the Water Hyacinth. This is a plant which blocks light for photosynthesis, which greatly reduces oxygen levels in the water. This reduction in oxygen in turn reduces other underwater life such as fish and other plants, thus depleting biological diversity which alters an ecosystem's animal community.*

*(For more information, see: <http://www.protectyourwaters.net/impacts.php>)*

## **6. What are some impacts of aquatic invasive species? How do invasive species affect water resources and what are the associated effects?**

*Invasive aquatic plants and animals destroy habitats in coastal waterways and interrupt the flow of water in inland desert irrigation canals. They clog storm canals leading to the flooding of homes and displace native species in our nation's wetlands. Furthermore, they compete with native species for resources, often leading to a decline in the population of native species. One example of this is seen in the competition between the native Cutthroat Trout and the nonnative Brown Trout in many rivers within Utah. Both are competing for the same food source, which is causing a decline in the native Cutthroat Trout population.*



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**7. Invasive species have a place in their native habitat. When introduced to a new habitat, they are only doing what every other organism does: taking advantage of opportunities to survive and perpetuate their species. How does knowing this change our actions in order to mitigate the spread of invasive species?**

*Most invasive insects, marine invertebrates, and microorganisms are accidentally introduced. For this reason, most countries have many restrictions and regulations in place detailing how imported and exported products will be monitored.*

**8. What are our future management, policy, and societal needs to lessen or adapt to the effects of invasive species as they alter aquatic ecosystems?**

*“The best way to limit impacts of non-native species is to prevent them from invading and becoming established in a new area. If this fails, eradication may still be possible, but generally only if the species is identified and treated quickly. Once established, efforts to restrict spread to uninfested areas can limit further damage. Controlling population sizes in heavily invaded areas can also reduce deleterious effects, but is unlikely to lead to eradication. Last, maintaining healthy natural communities, either by limiting human disturbance, or restoring of previously impacted areas, can limit opportunities for exotics to take hold.”*

<http://www.esa.org/education/edupdfs/invasion.pdf>

**9. What can you do to prevent the spread of invasive species?**

- *Inspect your boat and equipment (waders, ect). Remove any plants or animals.*
- *Decontaminate boats and equipment before use in another waterbody.*
- *Drain water from the motor and all containers including, balast tank, bilge, and transom well and allow them to dry.*
- *Never transfer live aquatic species from one water body into another.*
- *Never dump [aquarium](#) plants or pets in lakes or streams.*
- *Don't plant invasive species in your yard or garden.*
- *Get involved in a project to remove invasive species.*

## Research Worksheet

Name: \_\_\_\_\_ Date: \_\_\_\_\_

When filling out the answers below, remember to cite the website and author from each answer on the back of this page.

1. What is the common name of the aquatic invasive species you chose? \_\_\_\_\_

2. What is the scientific name of the aquatic invasive species? \_\_\_\_\_

3. Describe 3 characteristics of the aquatic invasive species.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

4. Where did your aquatic invasive species originate? \_\_\_\_\_  
\_\_\_\_\_

5. What is the current geographical range of your aquatic invasive species? \_\_\_\_\_  
\_\_\_\_\_

6. How was your aquatic invasive species introduced to that range? \_\_\_\_\_  
\_\_\_\_\_

7. Give 3 reasons why the spread of your aquatic invasive species is harmful and should be prevented.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

8. Name 2 ways the spread of your aquatic invasive species can be prevented.

1. \_\_\_\_\_
2. \_\_\_\_\_

9. Name and describe a plan your state has in place to manage your aquatic invasive species. If a plan does not currently exist, what would you do? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

10. Give one cool fact about your aquatic invasive species. \_\_\_\_\_  
\_\_\_\_\_

## Citations

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# List of Aquatic Invasive Species

## Pathogens and parasites

- o Whirling Disease (*Myxobolus cerebralis*)
  - Original distribution: In Europe in brown trout
  - Invasive distribution: It is in the Western and North Eastern United States



wildlife.state.co.us

- o Asian Tapeworm (*Bothriocephalus acheilognathi*)
  - Original distribution: This species is native to East Asia
  - Invasive distribution: It is known in several areas of the United States. It appears to be well established in the lower Colorado River and the Hawaiian islands, and has recently been reported in the Great Lakes.



sci.sdsu.edu

## Fungus and Algae

- o Chytrid (*Batrachochytrium dendrobatidis*)
  - Original distribution: South Africa
  - Invasive distribution: It is presently found in Australia; Africa; North, Central and South America; Europe; New Zealand; and Oceania. It is found across the United States, including across all of Utah.
- o Rock Snot (*Didymosphenia geminata*)
  - Original distribution: Northern Europe and northern North America
  - Invasive distribution: Scattered populations exist throughout the United States, including New England, the Mid-Atlantic Region, and the Western U.S.



frogsabound.org



cisr.ucr.edu



## Plants

- o Common Reed (*Phragmites australis*)
  - Original distribution: Native to U.S., but the more invasive strains originated in Europe
  - Invasive distribution: Distributed across the United States and is now common to wetland areas and canals of Utah and is known to inhabit all counties in Utah.



britannica.com

- o Tamarisk (*Tamarix spp.*)
  - Original distribution: Native to Asia and southeastern Europe
  - Invasive distribution: It is now found in 42 of the 48 continental states, including Utah



oregonlive.com

- o Purple Loosestrife (*Lythrum salicaria*)
  - Original distribution: Eurasia
  - Invasive distribution: This plant is found from the northeast to the western United States and north into Canada. It currently inhabits 43 of the 48 contiguous states, including Utah.



magicoflife.org

- o Eurasian watermilfoil (*Myriophyllum spicatum*)
  - Original distribution: Native to Europe, Asia and northern Africa
  - Invasive distribution: Its presence is currently confirmed in 45 states, including Utah and three Canadian Provinces



usanpn.org

- o Curly-leaf pondweed (*Potamogeton crispus*)
  - Original distribution: Native to Eurasia, Africa and Australia
  - Invasive distribution: This species has spread throughout the United States and is now prevalent in the ponds and marshes of northern Utah



urbanmonitoring.ca

## Mollusks

- o Asian Clam (*Corbicula fluminea*)
  - Original distribution: Southeastern Asia
  - Invasive distribution: It is found in 38 states, including Utah, and the District of Columbia



[nas.er.usgs.gov](http://nas.er.usgs.gov)

- o Red-rimmed Melania (*Melanoides tuberculatus*)
  - Original distribution: Northern Africa to southern Asia
  - Invasive distribution: Confirmed in 12 western and southern states, including Utah



[nas.er.usgs.gov](http://nas.er.usgs.gov)

## Dreissena Mussels

- o Quagga Mussel (*Dreissena bugensis*)
  - Original distribution: Dneiper River drainage of Ukraine
  - Invasive distribution: Currently distributed in all five Great Lakes, throughout the St. Lawrence River north to Quebec City, and in New York, Ohio, Michigan, Pennsylvania, and southwestern United States, including Utah



[seagrant.umn.edu](http://seagrant.umn.edu)

- o Zebra Mussel (*Dreissena. Polymorpha*)
  - Original distribution: The Black, Caspian and Azov seas
  - Invasive distribution: Europe and the Mississippi River drainage.



[fl.biology.usgs.gov](http://fl.biology.usgs.gov)

- o New Zealand Mudsnail (*Potamopyrgus antipodarum*)
  - Original Distribution: New Zealand
  - Invasive Distribution: Australia, Europe, Asia, and North America—now locally abundant in western rivers, including Utah



[esg.montana.edu](http://esg.montana.edu)

## Fish

- o Western Mosquitofish (*Gambusia affinis*)
  - Original distribution: Native to the south-central United States and Mexico
  - Invasive distribution: Pan-global distribution including most of the United States



[fishtankforum.co.uk](http://fishtankforum.co.uk)

- o Burbot (*Lota lota*)
  - Original distribution: Burbot are native to Alaska, Canada and the northern continental U.S., with their range extending as far south as Wyoming and northeastern Utah
  - Invasive distribution: Populations are now established in Connecticut, Illinois, Indiana, New Jersey, Ohio and Pennsylvania and various locations within Utah



[fwp.mt.gov](http://fwp.mt.gov)

## Amphibians

- o North American Bullfrog (*Rana catesbeiana*)
  - Original distribution: Eastern United States, but historically absent from the Cape Cod archipelago and associated islands
  - Invasive distribution: 11 states, including Utah



[georgiaencyclopedia.org](http://georgiaencyclopedia.org)

- o Plains Leopard Frog (*Rana blairi*)
  - Original distribution: Southern Canada and the northern United States
  - Invasive distribution: 3 western states, including Utah



[ndis.nrel.colostate.edu](http://ndis.nrel.colostate.edu)

## Reptiles

- o Red-Eared Slider (*Trachemys scripta elegans*)
  - Original distribution: the Mississippi valley from northern Illinois and Indiana to the northern Gulf of Mexico, west to Texas and east to western Alabama
  - Invasive distribution: 23 states, including Utah, as well as areas in Canada, Mexico, the Caribbean, and other global locations



[blog.nus.edu.sg](http://blog.nus.edu.sg)

# Notes

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## Sample Poster

# ***Utah's Most UN-Wanted***

*Potamopyrgus antipodarum*



Alias: New Zealand Mudsnail

**Why unwanted:** The New Zealand Mudsnail outcompetes native invertebrates for food and space because its population densities exceed 100,000 individuals per square meter. The Mudsnail can consume up to 75% of the gross primary production. This species has recently been seen biofouling, or accumulating in overwhelming numbers, in wetland areas.

**Description:** Small (<5mm), invasive, hydrobiid snail. It has an elongate, dextral shell that varies in color and typically has 5 to 6 whorls at maturity.

**Originally from:** New Zealand

**Sightings:** The New Zealand Mudsnail has been sighted in Australia, Europe, Asia and North America. In Utah, New Zealand Mudsnails are found in most of the major river drainages of the northern part of the state and in the Green River.

**Mode of transport:** The New Zealand Mudsnail is known to spread through the commercial transport of aquaculture products, independent locomotion upstream, recreational equipment, and the alimentary canals of fish.

**Threat:** This invasive species typically occurs in systems with high primary productivity, constant temperatures and constant flow. Furthermore, it is able to adapt to a wide range of temperatures, salinities, and [substrates](#).

**What you can do:** Properly decontaminate any equipment used in the water through desiccation and freezing, or an appropriate cleaning solution.

